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EXAMINER	
TURNER, KATHERINE ANN	

ART UNIT	PAPER NUMBER
4132	

NOTIFICATION DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

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Office Action Summary	**Application No.** 10/807,333	**Applicant(s)** OKUYAMA ET AL.	
	Examiner Katherine Turner	**Art Unit** 4132	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *24 March 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *3/24/2004*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Priority

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Specification

2. The disclosure is objected to because of the following informalities: There is a typographical error on page 15, line 15 of disclosure; "pores" is spelled "poles."

Appropriate correction is required.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

5. Claims 1-3, 5-6, 10-12, 15, and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kaplan et al. (US 6,270,921 B1) in view of Okazaki et al. (JP401059782A).

As to claims 1 and 15, Kaplan et al. teaches an air battery (10) comprising:

- a cathode can (50 and 320) (applicant's container) having a surface in which openings (100) (applicant's air pores) are formed (figures 1 and 6; column 2, lines 61-63; column 3, lines 3-4; column 4, lines 41-46; column 6, lines 55-61);
- an electrode group provided in the battery container and including a cathode (80 and 400) (applicant's air positive electrode) (figures 1 and 6; column 1, line 29; column 2, line 65; column 7, line 5),
- an anode (40 and 420) (applicant's negative electrode) (figures 1 and 6; column 1, line 28; column 3, line 13; column 7, lines 6-7),
- and a separator (90 and 410) provided between the cathode and the anode (figures 1 and 6; column 2, line 65; column 6, lines 19-32; column 7, line 6);
- a membrane (70 and 390) (applicant's barrier film) which is provided between the surface of the cathode can (50 and 320) (applicant's battery container) and the cathode (80 and 400) (applicant's positive electrode) of the electrode group (figures 1 and 6; column 5, lines 11-17),
- and an air diffusion layer (60 and 380) (applicant's gap holding member)
- the membrane (70 and 390) (applicant's barrier film) can be laminated onto the cathode can (50 and 320) (applicant's container) (column 5, lines 14-15), and the cathode can (50 and 320) has the air diffusion layer (60 and 380) sealed onto it (column 4, lines 63-67), therefore the membrane (70 and 390)

can be laminated onto the air diffusion layer (60 and 380) and together they comprise a laminate sheet (figures 1 and 6)

- and the membrane (70 and 390) (applicant's barrier film) is opposite to the cathode (80 and 400) (applicant's positive electrode) (figures 1 and 6; column 4, lines 62-65; column 5, lines 4-16),
- and the air diffusion layer (60 and 380) (applicant's gap holding member) comprising a porous film (figures 1 and 6; column 5, lines 4-11),
- wherein the openings (100 and 370) (applicant's air pores) of the cathode can (50 and 320) (applicant's battery container) are sealed by the air diffusion layer (60 and 380) (applicant's gap holding member) and membrane (70 and 390) (applicant's barrier film) laminated together (figures 1 and 6; column 4, lines 62-65; column 5 lines 13-15).

Kaplan et al. discloses a membrane (70 and 390) (applicant's barrier film), but does not disclose the oxygen permeation coefficient of the membrane.

Okazaki et al. teaches an air battery utilizing a thin film (11) applicant's barrier film) polymethylpentene (Abstract). It would have been obvious to one of ordinary skill in the art at the time of the invention to substitute Kaplan et al.'s membrane for Okazaki et al.'s polymethylpentene film, because they are art recognized equivalents as barrier film materials (See MPEP 2144.06). Applicant discloses that polymethylpentene film has the oxygen permeation coefficient of 4.9 x 10^{-5} mol•m/m^2•sec•Pa (page 39, table 1). Thus, Kaplan et al. modified by Okazaki et al. necessarily has the oxygen permeation coefficient of 1x10^{-14} mol•m/m^2•sec•Pa or less.

It has been held by the courts that if the prior art teaches the identical chemical structure, the properties applicant discloses and/or claims are necessarily present. In re Spada, 911 F2d. 705, 709, 15 USPQ2d 1655, 1658 (Fed. Cir. 1990). See MPEP 2112.01.

Regarding claim 2, Kaplan et al. is silent as to the internal pressure in the air battery container during continuous discharge. The applicant's disclosure states that the internal pressure can be kept lower than atmospheric pressure by 0.1 to 80 kPa during continuous discharge if the barrier film has an oxygen permeation coefficient of $1x10^{-14}$ mol•m/m^2•sec•Pa or less (page 8, lines 21-27; page 9, line 1), and the ratio of the gap in the battery container, except for the portion of the laminated sheet, is in the range of 5 to 40% (page 9, lines 12-15).

The ratio of the gap in the air battery container, the area between the cathode and anode cans (20, 50, 310, and 320), of Kaplan et al. is within the range of 5 to 40% (figures 1 and 6). The cathode can (50 and 320) has a height of 4 mm and a thickness of 0.25 to 0.5 mm (column 4, lines 41-49), the anode can (20 and 310) has a thickness of 0.2 to 0.5 mm (column 3, lines 3-4), the air diffusion layer (60 and 380) has a thickness of 0.1 to 0.2 mm (column 5, lines 7-11), and the membrane (70 and 390) has a thickness of 0.1mm (column 5, lines 12-15). Working with these numbers, the space inside the battery container is the thicknesses of the containers top and bottom faces (0.25 to 0.5mm and 0.2 to 0.5 mm) subtracted from the height of the container (4 mm), which equals 3 to 3.55 mm. The thickness of the gap is the thickness of the air diffusion layer (0.1 to 0.2 mm) added to thickness of the membrane (0.1 mm), which equals 0.2

to 0.3 mm. The ratio of the gap (0.2 to 0.3 mm) in the battery container (3 to 3.55 mm) is 5.6 to 10%, which falls within the range of 5 to 40%.

Therefore, Kaplan et al in view of Okazaki et al. necessarily possesses the internal pressure in the battery container kept lower than atmospheric pressure by 0.1 to 80 kPa during continuous discharge.

Regarding claim 3, Kaplan et al. teaches an air battery wherein the ratio of the gap in the battery container except the portion of the laminated sheet is 5.6 to 10%, which falls into the range of 5 to 40% (figures 1 and 6; column 3, lines 3-4; column 4, lines 41-49; column 5, lines 7-15). The applicant is directed above for complete discussion of the ratio of the gap calculations.

Regarding claim 5, Kaplan et al. teaches a membrane (70 and 390) (applicant's barrier film) of a hydrophobic material containing a fluoroplastic polymer, and the thickness of 100 μm, which falls within the range of 1 to 100 μm (figures 1 and 6; column 5, lines13-14; polytetrafluoroethylene is a hydrophobic fluoroplastic polymer).

Regarding claim 6, Kaplan et al. teaches an air diffusion layer (60 and 380) (applicant's gap holding member) of 100 to 200 μm, which falls within the range of 10 to 500 μm (figures 1 and 6; column 5, lines 7-8).

Regarding claims 10, 11, and 20, Kaplan et al. discloses an air diffusion layer (60 and 380) (applicant's gap holding member) which is sealed to the cathode can (column 4, lines 63-67), with a membrane (70 and 390) (applicant's barrier film) which is then laminated onto the cathode can (50 and 320) (column 5, lines 14-15) upon the already sealed air diffusion layer (60 and 380) (figures 1 and 6; column 4, lines 63-67), but is

silent as to the laminated air diffusion layer and membrane further comprising a second gap holding member (applicant's claim 10 and 20), comprising at least one selected from the group of a porous film, a nonwoven fabric, and a woven fabric (applicant's claim 11). Okazaki et al. teaches a second porous body (4) (applicant's second gap holding member) which is layered in between the nonporous polymethylpentene film (applicant's barrier film) and the battery container with air intake holes (3) (applicant's air pores) (figures 1-2; Abstract). The polymethylpentene film is layered between the second porous body (4) and the porous film (2) which is the nearest layer to the cathode (figures 1-2; Abstract). Okazaki et al. further teaches that the second porous body (applicant's second gap holding member) is made of a porous film (Abstract). It would have been obvious to one of ordinary skill in the art at the time of the invention to add a second gap holding member to the laminated layers of Kaplan et al., for the benefit of optimizing oxygen diffusion, as taught by Okazaki et al. (Abstract).

Regarding claim 12, Kaplan et al. teaches a cathode (80 and 400) (applicant's air positive electrode) containing carbon (figures 1, 2 and 6; column 5, lines 31-32).

6. Claims 4 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kaplan et al. in view of Okazaki et al. as applied to claims 1 and 15 above, and further in view of Arao et al. (WO 2063703 A1; relying upon an English equivalent US 7,205,042 B2 for citation), evidenced by Rosato et al. (Injection molding Handbook; 3rd Edition; Rosato, Dominick V.; Rosato, Donald V.; Rosato, M.G.; 2000; Springer - Verlag).

Kaplan et al. modified by Okazaki et al. teaches all the limitations of claims 1 and 15, and are incorporated herein. Regarding claims 4 and 19, Kaplan et al. in view of Okazaki et al. is silent as to the battery container being formed of a laminate film containing aluminum and satisfying the $(Y \times T) < 10^2$ formula. It is known in the battery art to utilize a laminate film containing aluminum and satisfying the $(Y \times T) < 10^2$ formula for battery containers, as taught by Arao et al. Arao et al. teaches the aluminum foil can be as thick as 100 μm (column 3, line 30), and the polypropylene resin can be as thick as 100 μm (column 7, lines 43-45; column 7, lines 50-54; column 8, lines 32-35). It is known that aluminum has a Young's modulus of 76×10^3 MPa, as taught by Rosato et al. (page 1325, Table 17-1) with a thickness of 100×10^{-6} m which would lead to $Y \times T = 7.6$. It is known that polypropylene has a Young's modulus of 50×10^3 MPa, as taught by Rosato et al. (page 1325, Table 17-1) with a thickness of 100×10^{-6} m which would lead to $Y \times T = 5$. Therefore each film separately and as a laminate satisfies the formula. It would have been obvious to one of ordinary skill in the art at the time of the invention to substitute Arao et al.'s aluminum resin material for Kaplan et al.'s steel nickel material (column 4, lines 41-43) because aluminum resin and steel nickel are art recognized equivalents as a battery container material. See MPEP 2144.06

7. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kaplan et al. in view of Okazaki et al. as applied to claim 1 above, and further in view of Kelsey et al. (US 2002/0132161 A1).

Kaplan et al. in view of Okazaki et al. teaches all the limitations of claim 1 and is incorporated herein. Regarding claim 7, Kaplan et al. in view of Okazaki et al. teaches

a porous film (applicant's gap holding member), but is silent as to the range of porosity of the porous film. Kelsey et al. teaches that barrier layers (applicant's gap holding member) area modified or altered to affect, e.g., increase or decrease, the mass transport resistance of the battery cells (paragraph [0056], lines 1-3). Kelsey et al. further teaches that the degree of modification can vary and can be controlled, for example, by controlling the amount of work applied. In embodiments, relative to an area that is not altered, the altered areas can have a lower porosity, e.g., 90%, 80%, 70%, 60%, 50%, 40%, 30%, 20%, or 10% of the porosity of the unaltered area. The unaltered and altered areas can have similar differences in terms of mass transport resistance and/or density. Thus, Kelsey et al. teaches that barrier layers' (applicant's gap holding member) porosity is a result effective variable. It would have been obvious to one of ordinary skill in the art at the time of the invention to vary the porosity of the film for the benefit of adjusting the mass transport properties of the film, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). MPEP 2144005 IIB

8. Claims 8-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kaplan et al. in view of Okazaki et al. as applied to claim 1 above, and further in view of Yoshino et al. (JP02060052A).

Kaplan et al. in view of Okazaki et al. teaches all the limitations of claim 1 and is incorporated herein. Regarding claims 8 and 9, Kaplan et al. in view of Okazaki et al. discloses a porous film (applicant's gap holding member), but is silent as to the air

permeability of the porous film being 1000 sec/100cm^3 or less (applicant's claim 8), and the type of material that the porous film is made of (applicant's claim 9). Yoshino et al. teaches polypropylene and polyethylene as the porous film (applicant's gap holding member) (Abstract). It would have been obvious to one of ordinary skill in the art at the time of the invention to substitute Kaplan et al.'s porous film for Yoshino et al.'s polypropylene and polyethylene film, which are both polyolefin film; because they are art recognized equivalents as porous film materials (See MPEP 2144.06). Applicant discloses that polypropylene film has the air permeability of 4.5 sec/100 cm^3 (page 39, table 1), and that polyethylene film has the air permeability of 450 sec/100 cm^3 (page 39, table 1). Thus, Kaplan et al. modified by Yoshino et al. necessarily has air permeability of the porous film being 1000 sec/100cm^3 or less.

It has been held by the courts that if the prior art teaches the identical chemical structure, the properties applicant discloses and/or claims are necessarily present. In re Spada, 911 F2d. 705, 709, 15 USPQ2d 1655, 1658 (Fed. Cir. 1990). See MPEP 2112.01.

9. Claims 13-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kaplan et al. in view of Okazaki et al. as applied to claim 1 above, and further in view of Abraham et al. (J. Electrochem. Soc., Vol. 143, No. 1, January 1996; cited in Information Disclosure Statement).

Kaplan et al. in view of Okazaki et al. teaches all the limitations of claim 1 and is incorporated herein. Regarding claim 13, Kaplan et al. teaches that one type of air recovery battery employs a typical anode containing zinc (column 1, Introduction

section, lines 27-30; column 3, lines 42-43), but is silent as to the negative electrode active material being one of the group consisting of a carbonaceous material capable of deintercalating an alkaline metal ion or alkaline earth metal ion, a metal compound capable of deintercalating an alkaline metal ion or alkaline earth metal ion, an alkaline metal, and an alkaline earth metal.

It is known in the air battery art to utilize a negative electrode active material from the group above, as taught by Abraham et al. (figure 1; page 1, column 1, paragraph 2; the negative electrode is lithium).

It would have been obvious to one of ordinary skill in the air battery art at the time of the invention to utilize lithium as a anode in the air battery of Kaplan et al., because of the reduction of space needed to house the lithium negative electrode, and the increased environmental benefits of a lithium negative electrode as taught by Abraham et al. (page 5, column 1, Conclusions section, paragraph 2), and because they are art recognized equivalents as anode materials.

Regarding claim 14, Kaplan et al. teaches a separator which electronically insulates the cathode from the anode (90 and 410) (applicant's positive and negative electrode) (figures 1 and 6; column 6, lines 19-32), but is silent to electrolyte held in the separator.

It is known in the air battery art to hold electrolyte in the separator, as taught by Abraham et al. (page 1, Introduction section, column 1, paragraph 2, lines 9-13).

It would have been obvious to one of ordinary skill in the air battery art at the time of the invention to hold electrolyte in the separator of Kaplan et al., because the

separator of Abraham et al. provides a medium for electrolyte transport between the anode and the cathode, which is necessary for the battery to operate, while still providing electronic insulation of the cathode from the anode, as taught by Abraham et al. (page 1, Introduction section, column 1, paragraph 2, lines 9-13).

10. Claims 16-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kaplan et al. in view of Okazaki et al. as applied to claims 1 and 15 above, and further in view of Tinker (US 5,506,067).

Kaplan et al. in view of Okazaki et al. teaches all the limitations of claims 1 and 15 and is incorporated herein. Regarding claim 16, the references are silent as to the electrode group contained in a bag formed of the laminated sheet. It is known in the battery art to contain the cathode and anode (20 and 14) (applicant's electrode group) in a bag formed of the gas-permeable, liquid-impermeable membrane (106) (applicant's laminated sheet), as taught by Tinker (figure 3; column 9, lines 3-7). It would have been obvious to one of ordinary skill in the battery art at the time of the invention to contain the electrode group of Kaplan et al. in a bag formed of the laminated sheet, because it provides a liquid-impermeable layer to retain electrolyte within the cell case as taught by Tinker (column 9, lines 5-7).

Regarding claim 17, Kaplan et al. is silent as to the internal pressure in the air battery container during continuous discharge. The applicant's disclosure states that the internal pressure can be kept lower than atmospheric pressure by 0.1 to 80 kPa during continuous discharge if the barrier film has an oxygen permeation coefficient of $1x10^{-14}$ mol•m/m^2•sec•Pa or less (page 8, lines 21-27; page 9, line 1), and the ratio of

the gap in the battery container, except for the portion of the laminated sheet, is in the range of 5 to 40% (page 9, lines 12-15).

The ratio of the gap in the air battery container, the area between the cathode and anode cans (20, 50, 310, and 320), of Kaplan et al. is within the range of 5 to 40% (figures 1 and 6). The cathode can (50 and 320) has a height of 4 mm and a thickness of 0.25 to 0.5 mm (column 4, lines 41-49), the anode can (20 and 310) has a thickness of 0.2 to 0.5 mm (column 3, lines 3-4), the air diffusion layer (60 and 380) has a thickness of 0.1 to 0.2 mm (column 5, lines 7-11), and the membrane (70 and 390) has a thickness of 0.1mm (column 5, lines 12-15). Working with these numbers, the space inside the battery container is the thicknesses of the containers top and bottom faces (0.25 to 0.5mm and 0.2 to 0.5 mm) subtracted from the height of the container (4 mm), which equals 3 to 3.55 mm. The thickness of the gap is the thickness of the air diffusion layer (0.1 to 0.2 mm) added to thickness of the membrane (0.1 mm), which equals 0.2 to 0.3 mm. The ratio of the gap (0.2 to 0.3 mm) in the battery container (3 to 3.55 mm) is 5.6 to 10%, which falls within the range of 5 to 40%.

Therefore, Kaplan et al in view of Okazaki et al. necessarily possesses the internal pressure in the battery container kept lower than atmospheric pressure by 0.1 to 80 kPa during continuous discharge.

Regarding claim 18, Kaplan et al. in view of Okazaki et al. teaches all the limitations of claims 1, 15, 16, and 17 and is incorporated herein. Kaplan et al. teaches an air battery wherein the ratio of the gap in the battery container except the portion of the laminated sheet is 5.6 to 10%, which falls into the range of 5 to 40% (figures 1 and

6; column 3, lines 3-4; column 4, lines 41-49; column 5, lines 7-15). The applicant is directed above for complete discussion of the ratio of the gap calculations.

Conclusion

11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Reynolds et al. (US 5,985,475) teaches a membrane for selective transport of oxygen in an air battery, with a barrier film comprising microporous polyethylene or polypropylene membranes (column 6, lines 54-59). Ma et al. (US 2002/0142203 A1) teaches a metal air battery, with gap holding member comprising woven, nonwoven or porous plastics materials (paragraph [0075], lines 12-14).

Correspondence/Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Katherine Turner whose telephone number is (571)270-5314. The examiner can normally be reached on Monday through Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jessica Ward can be reached on (571)272-1223. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/K. T./
Examiner, Art Unit 4132

/Jessica Ward/
Supervisory Patent Examiner, Art Unit 4132